

AL.2.1993-313

c.2

# Office Ergonomics Guide



**Alberta**  
GOVERNMENT OF ALBERTA



Digitized by the Internet Archive  
in 2015

<https://archive.org/details/officeergonomics00albe>

## TABLE OF CONTENTS

1.	INTRODUCTION .....	1
2.	THE BENEFITS OF ERGONOMICS .....	6
3.	GETTING STARTED .....	7
4.	ERGONOMIC ANALYSIS .....	7
5.	TASK ANALYSIS .....	8
6.	OFFICE EQUIPMENT .....	9
7.	OFFICE FURNITURE .....	11
	(a) Seating .....	11
	(b) Work Surfaces .....	16
	(c) Footrests .....	18
	(d) Document Holder .....	18
	(e) Task Lighting .....	18
8.	WORKPLACE .....	19
9.	ENVIRONMENTAL FACTORS .....	21
	(a) Lighting .....	21
	(b) Noise .....	27
	(c) Thermal .....	28
	(d) Relative Humidity .....	31
	(e) Quality Of Air .....	32
10.	JOB DESIGN .....	35
11.	TRAINING .....	36
12.	GLOSSARY OF TERMS .....	37
13.	LIST OF RESOURCES .....	39
	APPENDIX "A" - TASK DESCRIPTION FORM .....	41
	APPENDIX "B" - WORKSITE SKETCH .....	43



**Prepared For: Occupational Health & Safety  
(Personnel Administration Office)**

**INTRODUCTION**

Computers have become the dominant communication system in today's office. While computers bring many valuable features, they should be used as part of an integrated work environment designed for human use. People are the limiting factor in this work environment. Since the use of computers is so dependent upon human interaction, it is important to design the workplace and the working processes to meet the physical and mental needs of the computer user. The principles governing the design of the workplace to fit human function and function are known collectively as ergonomics.

Ergonomics is the process of designing jobs to fit people. Work should be designed so the equipment, furniture, tools, procedures and the environment, lighting, temperature, humidity, air quality and other elements all come together to fit the needs of people. In general, most health risks of the computer user can be avoided by the methods described in Figures 1(1) and 1(2).

**Prepared By: Office Ergonomics Working Committee**

*Marion Boon,  
Personnel Administration Office*

*Debbie Bassett,  
Transportation & Utilities*

*Nasrin Dhanani,  
Personnel Administration Office*

*Val Fedoruk,  
Public Works, Supply & Services*

*Sharon Kelly,  
Personnel Administration Office*

*Ben Simon,  
Education*

*Gerry Spratt,  
Personnel Administration Office*

*Veronica Wake,  
Transportation & Utilities*

*Sylvia Weber,  
Education*



## **INTRODUCTION**

Computers have become the dominant communication system in today's office. While computers have many unique features, they should be seen as part of an integrated work environment designed for human use. People are the limiting factor in this work environment. Since the use of computers is so dependent upon human interaction, it is important to design the workplace and the working conditions to meet the physical and mental needs of the computer user. The principles governing the design of the workplace to fit human form and function are known collectively as ergonomics.

Ergonomics is the process of designing jobs to fit people. Jobs should be designed so that equipment, furniture, tasks, procedures and the environment (lighting, temperature, humidity, air quality and noise control) all come together to fit the needs of people in general, as well as the needs of the specific individual doing the job as described in Figures (1(a)) and (1(b)).

**"Ergonomic furniture and equipment however, is only good to the degree that its adjustability is used on a regular basis by the user".**

Health problems of a muscular and visual nature are likely to occur if ergonomic principles are neglected in the design of the modern office.

The application of ergonomics to computer workstations requires participation of several key players:

**COMPUTER USERS** can contribute by discussing their concerns with their supervisors. They can participate in training and apply the ergonomic principles learned on an ongoing basis.

**SUPERVISORS AND MANAGERS** can become more knowledgeable about ergonomics and apply these principles in the workplace, not only in the initial stages but continuously through coaching existing workers and orientating and training new workers.

**DEPARTMENT ACCOMMODATION/FACILITY PERSONNEL** and purchasing agents also play an important role in the application of ergonomics in the office. The accommodation/facility personnel should become knowledgeable about the ergonomic principles relevant to providing suitable space, environmental conditions and the necessary utility services. Purchasing Agents should become familiar with the ergonomic aspects of the equipment and supportive furniture.

It is essential for these key players to work together as a team to identify ergonomic problems in the office and develop strategies for resolution.

This Guide discusses the key ergonomic factors to be considered in the design of workstations and environments where computers are required as part of the work performed. The organization of this Guide is based on several assumptions.

1. The Guide will be used by people confronted with the task of assessing or planning a particular workplace, for example supervisors, managers, accommodation/facility personnel and purchasing agents.
2. Users of the Guide will want to avoid technical explanations and terminology. Therefore, technical terms have been avoided except where essential. A "Glossary of Terms" has been included at the end of this Guide for reference in defining certain technical terms. Those who wish more detail, should refer to the CAN/CSA - Z412 - M89, *"Office Ergonomics A National Standard of Canada"*  
(see Resource Section).
3. The Guide will be considered as a comprehensive set of principles applicable in a given workplace. The total document is needed to adequately assess and design a computer workstation.
4. The information in this Guide reflects the most recent findings relating to the use of computers. Changes are to be expected in such a rapidly evolving field. These changes will be considered and where appropriate, included in future editions of the Guide.

## THE HUMAN - TASK - ENVIRONMENT SYSTEM MODEL

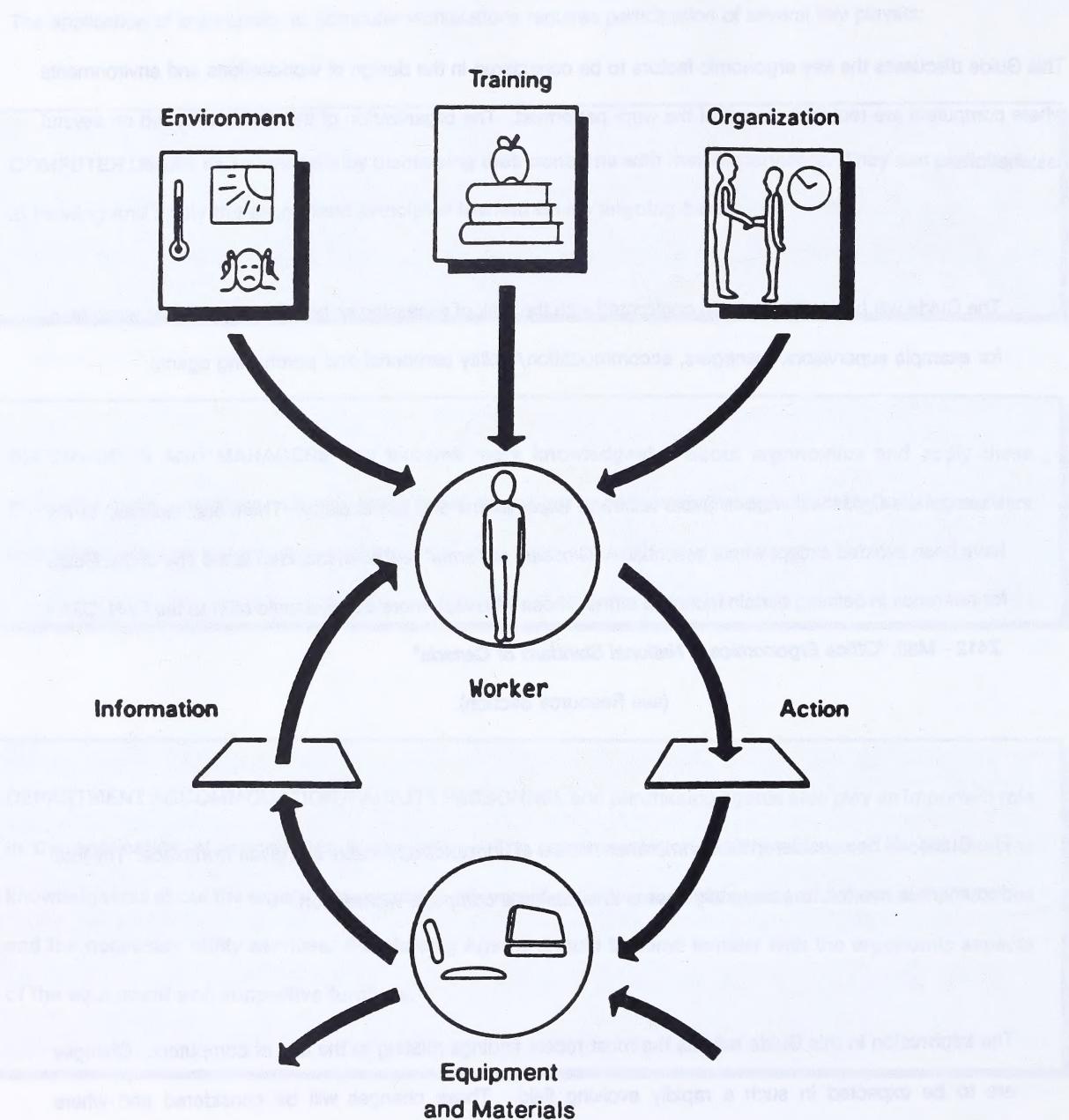
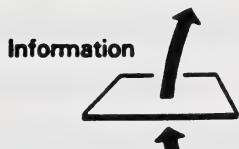


Figure 1 (a) Human-Task-Environment System

### COMPONENTS OF HUMAN - TASK - ENVIRONMENT SYSTEM



**Equipment and Furniture together with the Task**  
determine the demands that will be put on the person.



**Information** must be detected by the senses, recognized and then evaluated. Information presentation must match our sensory systems and the way our minds work: only then will recognition and evaluation be reliably smooth and accurate.



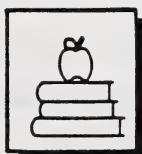
**Every Person Differs** in shape, size and experience. The best worksite will adjust to the different physical needs of every user.



**Action Patterns** are associated with every type of job. Consideration of reach, force, range of movement, and frequency of movement will result in work which is convenient and provides variety in exercise, without excess.



**The Physical Environment** requires careful consideration so that visual, acoustic and thermal needs are met for comfort and performance.



**The Training Environment** should ensure quick and accurate acquisition of critical skills and knowledge. To do so, it must consider the characteristics and existing skills of the newcomer in determining learning objectives and methods.



**The Organizational Environment** which can minimize monotonous work and offer social interaction, will be one in which any of us would be pleased to work.

Figure 1 (b)

## THE BENEFITS OF ERGONOMICS

When ergonomics is applied in the design of jobs, there are several benefits that make the investment worthwhile. **For the worker it means:**

- better designed workstation;
- improved environmental conditions;
- less fatigue and discomfort;
- elimination of excessive physical loads or stressful repetitive movements;
- increased feelings of health and well-being;
- improved overall health and safety;
- more feelings of control;
- reduced mental stress.

**But there are benefits for the employer also, and they include:**

- increased productivity;
- improved quality control;
- increased available work force by reducing absenteeism  
(prevention of repetitive strain injuries);
- less probability of error and accidents;
- better morale amongst workers;
- commitment to the job.

**COSTS WILL ALSO BE LESS** if ergonomics is applied early in the planning stage. The immediate cost may be high, but the long-term gain is significant. Compensation costs for musculoskeletal injuries and visual problems are reduced significantly when ergonomic principles are applied in the planning and operating stages of a job. *If ergonomics is applied as a reaction to serious problems after an office system is operational, costs will be significantly higher for refitting.*

## **GETTING STARTED**

The application of ergonomics depends on a systematic approach. All the elements in a system must fit together to form a smoothly functioning operation. This need not result in extra expense.

Rather than rushing to replace just one "obviously" deficient item in a person's working environment, consider all the elements that make up their job. Although this will seem more time consuming in the short term, it will increase the chances of success in the long term.

In other words, **IF YOU ARE GOING TO DO IT, DO IT RIGHT THE FIRST TIME!**

A practical way to do this is to conduct an ergonomic analysis of an existing workstation or when a new workstation is being designed.

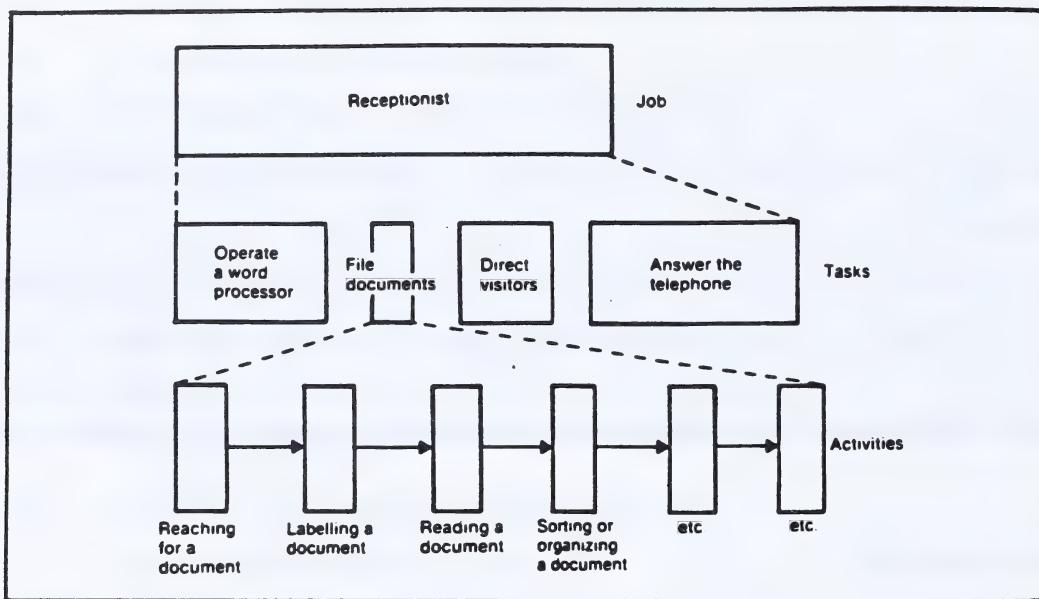
In the following pages you will find key information to help you in planning, developing and/or refitting ergonomic workstations in the office. Your Department Accommodation/Facilities contact person will assist you.

## **ERGONOMIC ANALYSIS**

Effective application of ergonomics requires a thorough analysis of the demands the work system places on each worker, the way adjacent jobs affect one another, and the effect of the environment. Effective analysis of task demands requires working closely with the people who do the work, professionals with appropriate expertise, and the managers who set the boundaries within which the work system has to function. It is important to remember that in applying ergonomic principles to the work system, the preferred approach is to fit the job to the person. This can be accomplished through proper design of equipment, furniture, work environment, workstation layout, work procedures, and providing operator training. An "Office Ergonomic Checklist" is available from your department accommodation/facilities contact and will assist you in designing an ergonomic workstation.

## TASK ANALYSIS

Most jobs are composed of several tasks. The first step in the ergonomic analysis of a particular job is to break it down into individual tasks. For example, a receptionist's task may be to operate a desktop computer, file documents, answer the telephone, and direct visitors. In turn, each task can be divided into a number of activities, such as reaching for a file and labelling it (see *Figure 2 and Figure 6*).



**Figure 2: Job Breakdown**

Using the Task Description form (**Appendix "A"**), list the tasks associated with each job and the percentage of time that the worker spends on each task. In the comments column, note any tasks that demand awkward postures, repetitive movements, or long reaches. Record any comments the workstation user may have. This information will be required in conjunction with other data gathered along with a floor plan sketch (**Appendix "B"**) to make decisions of how to set up a proper workplace (see page 19).

## **OFFICE EQUIPMENT**

In the automated office, computers with visual display screens, keyboards, printers and other special accessories are used for handling, processing, storage, retrieval and distribution of information. This requires an interface between equipment and the user. To maintain acceptable performance levels, the needs and limitations of each user should be recognized and satisfied by the equipment and the environment. Office equipment should be selected for ease of:

- **use;**
- **installation;**
- **operation;**
- **maintenance.**

### **INSTALLATION IS EASIER IF THE EQUIPMENT IS:**

- **lightweight or designed to be moved easily (handles);**
- **provided with features that promote proper positioning or mechanical connections;**
- **provided with instructions that are easy to follow.**

Appropriate wire management (the use of troughs) should be used to install the electrical, telephone, and coaxial cable services. The equipment should be equipped with the proper cords and cables of sufficient length to allow flexible placement. To prevent tripping hazards, excess cords and cables should be rolled up and stored neatly behind the equipment and kept out of the walking areas.

Ease of operation requires that displays are functionally designed so that they are easy to read or hear and provide the proper information. Controls should be grouped by sequence of function and easy to identify and reach from the operating position.

Maintenance requires less time to complete and is less prone to error if the equipment has been designed so that maintenance functions are easy to find and readily accessible. Proper installation of the equipment should also be considered to ensure that maintenance functions can be easily reached and are well lit.

Assistance in procuring office equipment that meets ergonomic standards is available from your Department Accommodation/Facilities contact person.

**For further information on the selection of proper ergonomically designed visual display terminals, keyboards, and screens, refer to Part 4 of the CAN/CSA Standard for Office Ergonomics referenced on Page 3**

## **OFFICE FURNITURE**

Office furniture has to support the user's body, the office equipment, and the work material. This includes the chair and work surface (table), and stationery items like the footrest and document holder.

Office workers spend long periods of time at their workstations and the effects of poor posture can cause musculoskeletal strain and injuries, visual fatigue and blood circulation problems.

Consideration must be given to the proper selection of office furniture and its arrangement so as to form a safe and efficient workstation.

Every worker should have a work space that conforms to individual differences in size and shape and accommodates task demands without risk of pain or injury. An ergonomic workstation provides for seating, work surfaces, storage and foot support.

### **(a) SEATING**

Seating should be of a design to meet the task at hand, provide a comfortable and stable support for the duration of the working day and be compatible with the other furniture. The specific seating characteristics to be considered when selecting a chair are outlined on the next page and in figures 3 and 4.

## ▲ Chair

### ▲ Seat Pan

- Width - at least 450 mm (18 in.)
- Height - adjustable with a range of 380 - 520 mm (15 - 20 in.) above floor
- Depth - between 380 - 430 mm (15 - 17 in.)
- Slope - adjustable between 3° forward and 4° back
- Seat - should have "waterfall" slope on front edge with no sharp edges
- Cushion - compression of about 25 mm (1 in.) and minimal contour

### ▲ Seat Back

- Width - between 350 - 480 mm (14 - 19 in.)
- Height - adjustable between 380 - 530 mm (15 - 20 in.) from top of backrest to top of seat pan
- Angle - vertical tilt between 95° - 110°
- Shape - curved in the vertical and horizontal planes with maximum indentation of 40 - 50 mm (1.5 - 2 in.)

### ▲ Seat Covering

- permeable, non-slippery fabric
- allows ventilation and absorption of perspiration
- no seams, buttons or folds that cause pressure points

#### ► Armrests (optional)

Apart	- minimum of 450 mm (18 in.) between inside edge
Height	- between 200 - 250 mm (8 - 10 in.) from top surface to top of seat pan
Width	- minimum of 50 mm (2 in.)
Length	- minimum of 150 mm (6 in.), not to extend beyond 300 mm (12 in.) from front of backrest
Detachable	- cantilever armrests retrofittable to existing chairs

## ► Controls

Controls can be either cylindrical or paddle or rotary for chair adjustments. They should be easily accessible and adjustable from the sitting positions. Recommended specifications for controls:

Cylindrical handle on levers for lateral movement	25-38 mm (1-1.5 in.) in diameter
Paddle handle	Paddle handle 50 mm <sup>2</sup> (2 in. <sup>2</sup> ) minimum area
Rotary control	Rotary Controls 50 mm (2 in.) minimum diameter

#### ► Chair base

The base of the chair should swivel through 360° and have hard casters for soft floor surfaces and soft casters for hard floor surfaces. The chair should have a five-pronged base with casters and a base diameter of 400 - 450 mm (16 - 18 in.).

Figure 3:  
Front View of Chair Dimensions

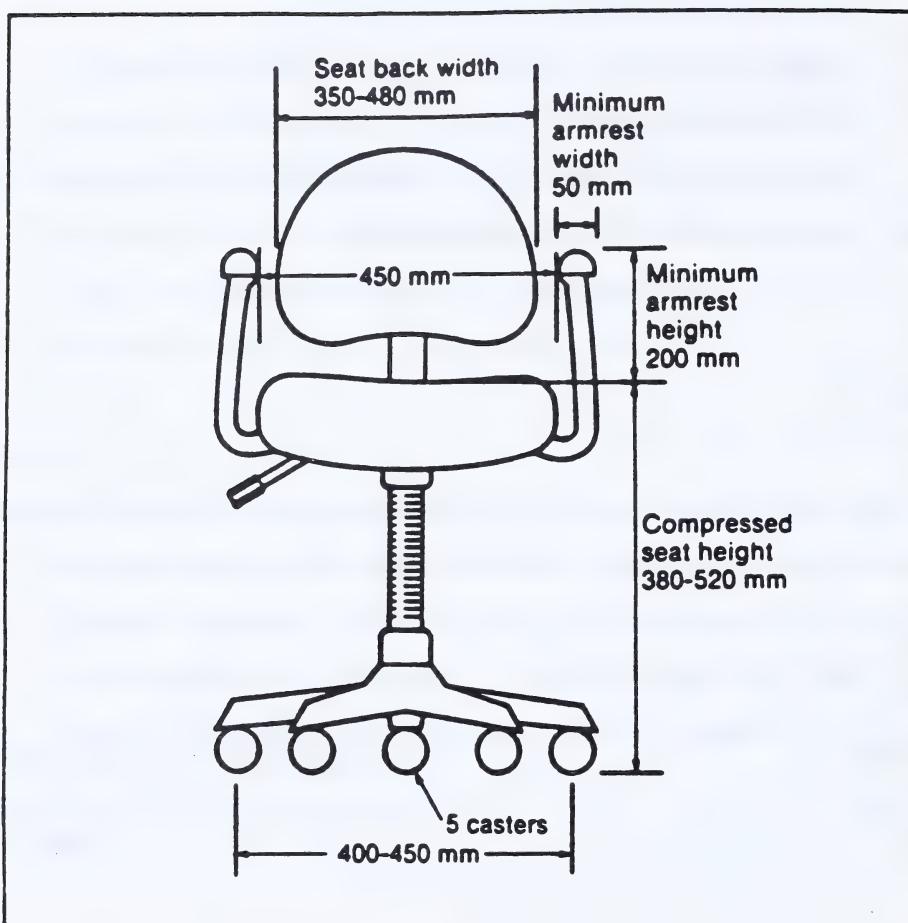
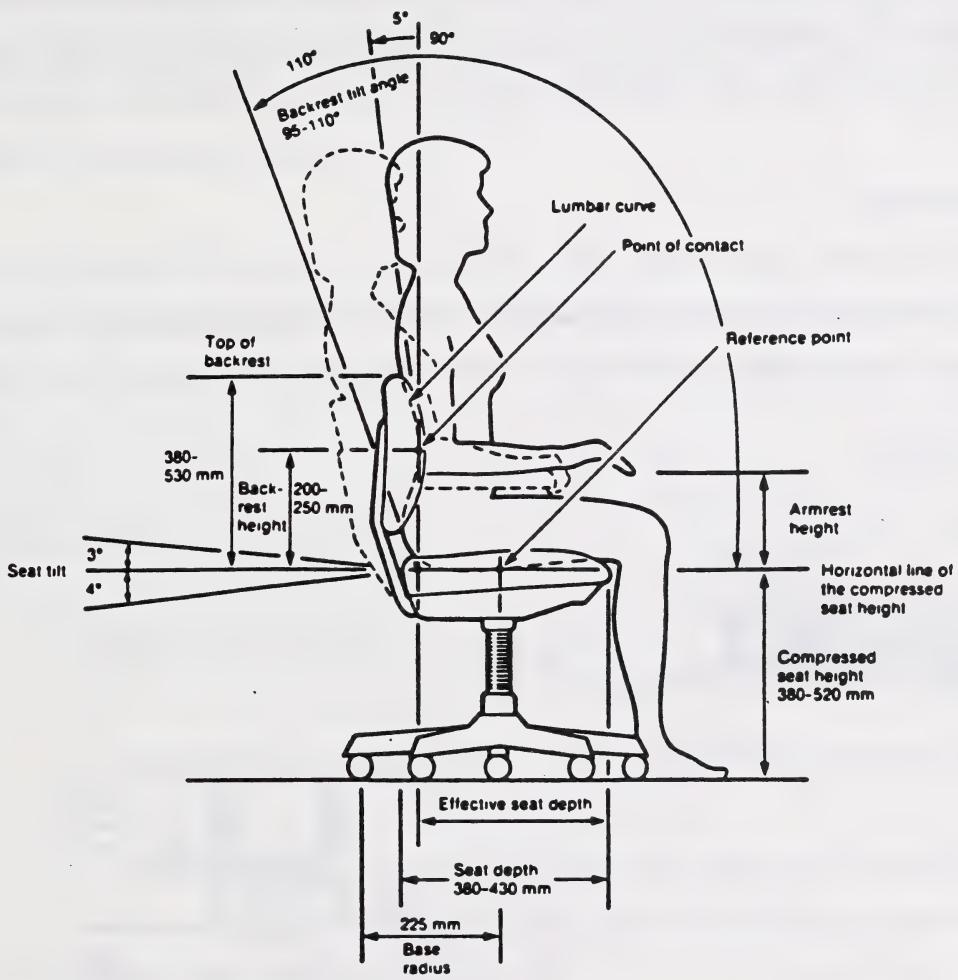


Figure 4:  
Side View of Chair Dimensions



For further information on the selection of ergonomic seating, consult with *Design Standards and Furniture Branch, P.W.S.S.* through your Department Accommodation/Facilities contact person or refer to Part 5 of the CAN/CSA Standard for Office Ergonomics.

### (b) WORK SURFACES

The work surface should be designed to provide the opportunity to place all material and equipment required to carry out the normal tasks, keeping in mind the spans of reach by the user to perform each task.

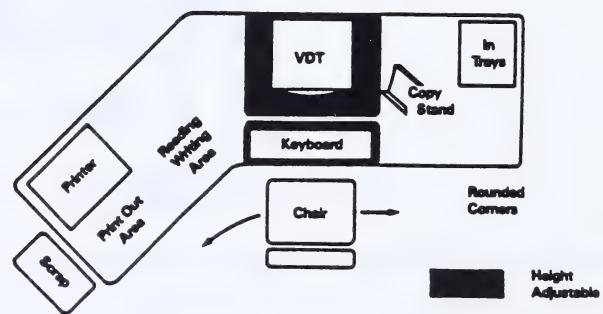
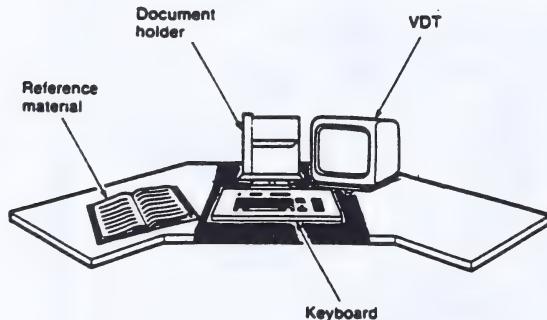


Figure 5: Alternative Computer Configurations

A horizontal work surface in the automated office usually has to accommodate a computer terminal with a keyboard, an area for writing and tabulating, an area for communication equipment, space to accommodate a printer and storage of resource material and computer accessories. In such cases, wrap around angled workstations will be more appropriate than rectangular ones (see *Figure 5*). This configuration allows free movement along the desk line with little obstruction to leg movement.

Not all the work surface area needs to be accessible in the same horizontal plane. Frequent or heavy reach requirements should be placed close at hand and more occasional requirements may be placed further away or on a different horizontal plane (shelves).

#### ▲ Work Surface Needs

Work surfaces should allow for:

- Repositioning of the computer screen and keyboard as required to accommodate the person and the task.
- A separate work surface for the keyboard independently adjustable for vertical height.
- Placement and use of accessories such as document stand, task lighting (if required), telephone, trays, card files, printer, etc.
- Placement of source and reference documents.
- Storage of accessories and personal items.

Since optimal writing height, keying height and screen viewing height will differ for each user, each height should be easily and independently adjustable from the sitting position (see figure 5).

The work surface should be thin enough and high enough to provide clearance for the thighs between the chair surface and the underside of the work surface.

**(c) FOOTRESTS**

Footrests should be used if the operator's feet cannot be placed flat on the floor when the seat height is properly adjusted. The footrest should have an upward slope between 10° and 20°, at least 300 mm (12 in.) wide by 300 mm (12 in.) deep, and be covered with a nonslip material. It is recommended that a footrest be available for every office workstation.

**(d) DOCUMENT HOLDER**

Frequently viewed copy material for data entry should be placed at the same height and distance as the screen and situated as close to the screen as possible. This can be done by using a document holder which will minimize head and body movement.

**(e) TASK LIGHTING**

Task lighting is a separate light system used to supplement ambient lighting levels in order to optimize the performance of visual tasks. This can be achieved by adding a small lamp to the workstation that can be positioned to provide illumination directly on a specific task. The lamp should be able to be adjusted so the light will not cause glare.

## WORKPLACE

The placement of people and equipment in the workplace should minimize distances between components that are important to each other or frequently communicate with each other, and the number of times personnel cross each other's paths. Some equipment may have special space requirements and need increased air flow to remove heat. Consideration must be given to sufficient space for freedom in entering and exiting from the workstation.

*With the information gathered in the Task Analysis, (see page 8) a floor plan sketch (see Figure 6 and Appendix "B") of the workplace should be completed. Pay attention to and indicate the positions of doors, windows, lights, equipment, and furniture.*

The connecting lines or links between personnel, equipment, and furniture that represent the daily movements of each office worker should be drawn on the floor plan sketch (see Figure 6). Identify the degree of importance of each link as high "H", medium "M", or low "L" depending on how frequently the worker moves between locations or how essential the link is. Attention should be directed to reducing the length of the high priority links.

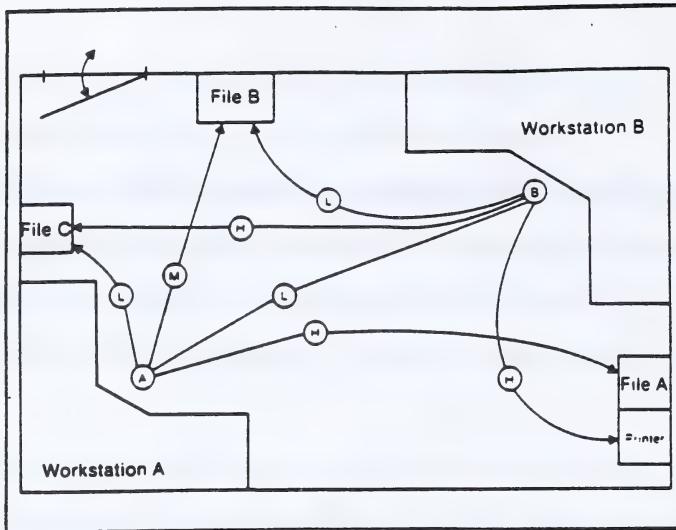


Figure 6: Link Analysis of Office

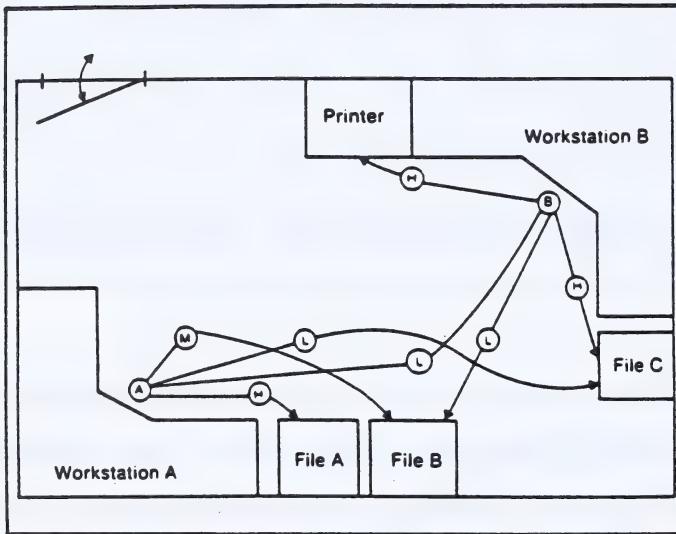


Figure 7: Rearrangement of Office with Links Redrawn

Examine the sketch to determine if rearranging the equipment or furniture can further reduce distances and crossings of people.

## **ENVIRONMENTAL FACTORS**

Environmental factors such as lighting, noise, thermal conditions, ventilation, and air quality influence the office workplace and the people working there.

### **(a) LIGHTING**

#### **▲ General**

Lighting for the electronic office containing computers is a complex issue. This is due to the nature and mix of visual tasks involved. Simple parameters such as the amount of the light at the workstation are not enough to address the problems associated with workstation lighting. Some basic guidance follows but for more information or advice the reader is directed to the following resources:

#### **▲ Standards**

##### ***Illuminating Engineering Society of North America (I.E.S.)***

- Lighting Handbook - Application and Reference Volumes
- Recommended Practise for Lighting Offices Containing Visual Display Terminals # IES RP-24-1989

#### **▲ Resources**

- Electrical Engineering Branch, Technical Resources Division,
- Alberta Public Works, Supply and Services

#### **▲ Visual Task**

Electronic offices contain a mix of computer and paper based visual tasks. Each task has its own particular requirements for lighting, some of which are mutually exclusive. Proper lighting for this type of work space involves striking a balance amongst the requirements for the various tasks.

#### **▲ Computer Task**

The computer task can be of three basic types. Viewing illuminated characters against a dark background, viewing dark characters against an illuminated background or viewing illuminated characters and background of contrasting colors. Because the task itself is illuminated, the brightness of the task and any light falling on the task from the environment will affect task visibility. Proper task visibility requires a balance between task brightness, surrounding brightness and screen illumination. Lighting must take vertical task orientation into account.

#### **▲ Associated Paper Task**

Paper tasks associated with computers are generally the same as for normal office space. They range from pencil on grey paper to high contrast print on white paper. Task orientation may be either vertical or horizontal.

#### ▲ Age of Viewer

As we age, the ability of our eyes to adjust to different focus lengths and light levels decreases. This means that lighting levels and control are more important for older age groups. Lighting levels and designs for Government offices should be aimed at an age group of 45 to 65 years.

#### ▲ Amount of Light (illuminance)

The amount of light is not the most critical component of proper lighting at a computer workstation, however there should be enough light for the paper based task without so much light that the computer task is washed out. Since paper based tasks still form a significant part of normal office work, lighting levels should be suitable for such tasks.

Lighting levels are measured using an illuminance meter. They can be measured in Footcandles (Fc) or Lux. Measurements should include illumination on vertical as well as horizontal surfaces. Acceptable lighting levels fall into a broad range of values. Lighting levels recommended by I.E.S. and P.W.S.S. are as follows:

I.E.S.

Horizontal - 550 to 1,100 Lux (50 to 100 Fc)

Vertical - 330 to 750 Lux (30 to 70 Fc)

#### ▲ A.P.W.S.S.

Standard lease and design requirements documents require a minimum horizontal illumination of 750 lux on the desktop. All areas of an office are not required to meet this minimum so some variation is permissible.

It should be noted that inexpensive light meters are generally of low accuracy and should not be used to make decisions regarding changes to the lighting system.

#### ▲ Brightness (*luminance*)

The ratio between the brightness of the various surfaces in the field of view has a major effect on task visibility.

Brightness ratios should be considered in the assessment of the lighting system.

#### ▲ Direct Glare

Bright sources such as windows and light fixtures in the direct field of view can cause visual discomfort and reduce task visibility. This problem can be eliminated or reduced by:

- controlling the brightness of such sources;
- orientating the workstation so the glare is removed from the direct field of view;
- the computer operator not directly facing a window or other bright light source;
- shielding the source from direct view;
- using blinds on windows.

#### ▲ ***Veiling Reflections***

Reflections of bright sources or light colored surfaces off of the surface of the task will reduce task contrast and visibility. This is particularly noticeable with computer screens due to their highly reflective surface and low brightness relative to the reflections.

#### **Types**

Reflections can occur in the computer screen, off glossy paper or off shiny type on matte paper. These reflections can be either well defined (specular) or diffuse. They can occupy small areas or cover the entire task. With computer screens, reflections can occur on the protective glass surface as well as the CRT tube itself which presents a double image.

#### **Sources**

Reflections can be caused by bright windows, light fixtures, bright parts of walls or partitions or light colored clothing. Even an evenly lit ceiling can be a problem if it is too bright or the tilt of the screen is wrong.

#### **Control**

Reflections can be controlled by workstation orientation, screening the light source or reducing the reflectivity of the task.

The computer should not be placed so that the operator faces either towards or away from a window. Screens should be at right angles to windows and other bright surfaces. Also the workstation should be placed so that light fixtures are to the sides rather than over, behind or in front of the screen.

*The screen should be tilted so that its surface is vertical in order to eliminate reflections of light fixtures. This usually also requires that the screen be placed at a level such that the top of the screen is at the same height as the eyes. Sometimes minor adjustments in screen tilt or rotation are enough to eliminate reflections and improve task visibility.*

#### ▲ ***Lighting Fixtures (Luminaires)***

Much office space used by the Government was built prior to the advent of large scale computer use and as such the light fixtures and layout were not designed for computer applications. Most lighting systems use direct fluorescent luminaires with standard diffusers. These can be a source of direct and reflected glare. Workstation and screen orientation is the simplest way to resolve these problems but in extreme cases some modification of the lighting system may be required.

Space for computers should be lit using either indirect or direct/indirect systems, low brightness (parabolic) luminaires or luminaires with low brightness diffusers. Most new office space is designed this way. However, for cost and other reasons, retrofits to existing space requires extensive analysis before proceeding with major changes of this type.

#### ▲ ***Computer Equipment***

Most newer computer screens are designed with glare reducing surfaces and tilt/swivel bases. This reduces reflection problems somewhat and makes adjustment easier.

The use of anti-glare filters or coatings on older screens is of questionable merit. Firstly, these reduce the brightness of the visual display causing them to be driven at higher than normal levels for good visibility thus shortening their life. Also, filters often introduce another reflection into the visual field which may make the problem worse. These devices are only recommended as a last resort.

## **(b) NOISE**

Most of the complaints received about noise in offices are related to noisy printers and other pieces of office equipment. Such noise sources should be assessed to determine what levels are being generated to cause the distraction and why. Some complaints may result because of excessive interference with verbal communication, either face to face or over the telephone. Others may complain because tasks that require concentration are more difficult to conduct in the presence of certain noises or that the noise is simply annoying.

In situations where concern is primarily due to office equipment, the noise levels should be surveyed with a sound level meter, using the A-weighted scale. The measurement results are then evaluated to determine the specific pieces of equipment causing the major amount of noise. Some methods of effectively controlling noise include placing the noisy equipment in an enclosure e.g. cabinet or room, or by increasing the distance between the source and the worker. Another method is substitution of a noisy piece of equipment with less noisy one e.g. laser printers.

Work requiring high levels of concentration should be conducted in a room isolated from the general office area where the noise is present.

**For further information on reducing noise in the office setting, consult with your Accommodation/Facilities contact person or Department occupational health and safety office.**

### **(c) THERMAL**

Thermal comfort, in an office environment, generally relates to an acceptable combination of air temperatures, ventilation and fresh air rates, relative humidity and quality of air.

No two people will react to a set office environment in the same fashion. Some like a cool working environment, some like a warmer working environment, others enjoy the feeling of air pulsating on them, while others object to any type of drafts. Workers generally dislike a stagnant air condition, and low humidity.

An optimum office environment would be one that could be controlled individually by each and every office occupant according to their own personal preference. Economically, the optimum office environment would be very costly to provide. The goal is to provide a comfortable environment for workers.

Thermal comfort conditions that are generally acceptable to the majority of people have been identified. The key is to provide these conditions at as constant a level as possible through the various seasonal cycles, on a day to day basis, as well as, on an hour by hour basis, through the course of a thermally changing day.

- ▲ **STANDARDS**

- **ASHRAE**

**ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers)** sets the standards to which all office environments are designed in North America and most of the rest of the world. The Alberta Government, in design of new office buildings, not only uses these standards, but is more specific on some of its conditions.

- **Alberta Building Code (ABC)**

The Alberta Building Code states that "Heating, ventilating and air-conditioning systems shall be designed to conform to good engineering practice such as described in the ASHRAE Handbooks".

A few of the ASHRAE standards are cited in the following sections:

- ▲ ***Temperatures***

Temperature is the only thermal comfort condition that can generally be controlled from within the office space by adjustment of a thermostat.

Alberta Government offices are designed to provide a temperature of 22°C. During summer months (cooling season), it is normal to expect temperatures to range from 22°C to 24°C. These are the ideal or "design" conditions.

#### **▲ Ventilation**

Air should be distributed to all office areas or workstations. The greater the degree of heat generating equipment such as computers, copiers, etc., the greater the amount of air required to cool the workstation (i.e. to remove the heat).

In certain instances where groupings of computers and computer processing equipment occur, additional (or separate) air conditioning equipment may be required to remove this added heat.

ASHRAE's latest standard recommends that office areas (newly designed facilities) be provided with a minimum of 10 L/S (litres per second) per person of fresh air. This means that the ventilation system provides this amount of filtered outdoor air for every occupant plus the amount of ventilation air (recirculated air) required to provide the necessary air conditioning.

Older ventilation systems may not be able to supply the amount of fresh air mentioned above as standards were not as high previously.

Supply air outlets (generally at the ceiling) are usually located strategically to provide as best a distribution to an office space as possible. Air should be directed along the ceiling or in a manner such that drafts are eliminated.

If changes are made at any time to the office floor plan with items such as furniture, acoustical screens, wall changes or partitions; it should be accompanied by a re-evaluation of the air distribution. e.g. relocating ceiling air outlets, adding others, or reducing air flow.

For further assistance, contact your ACCOMMODATION/FACILITIES contact person.

#### (d) RELATIVE HUMIDITY

Relative humidity (R.H.) refers to the percentage of moisture in the air. For example, a lower percentage of R.H. will increase the rate at which moisture evaporates off the skin, giving a person the feeling of coolness. This is why, in our dry climate, during the winter months we tend to raise the temperatures slightly in offices and homes to compensate for the coolness effect.

Low humidity can also cause other discomforts, such as nose, throat and eye irritation and can contribute, as some reports indicate, to increased incidents of colds and flu. It can also contribute to the build-up of static electricity which could affect the operation of electronic equipment (computers) and paper feed on printers and copiers. Grounded type static pads are placed under keyboards or computers to discharge static electricity build-up.

Alberta Public Works, Supply and Services guide for new facilities recommends 15% R.H. at -35°C, increasing proportionally to 25% R.H. at +5°C and greater than 25% R.H. at higher temperatures. Higher humidity levels at lower temperatures will result in condensation forming on windows with detrimental effects on the building structure.

*(Based on the above guidelines, relative humidity will still be 20% or higher for 90% of the year, which is quite satisfactory.)*

## **(e) QUALITY OF AIR**

The consideration of air quality is an important factor in acceptability of office environments in terms of worker health, comfort and performance.

Office buildings can contain a wide variety of contaminants, but the common airborne contaminants are carbon dioxide, carbon monoxide, formaldehyde, and respirable dust particulates. Other contaminants mentioned often, such as allergenic fungi, and Legionella bacterium, are more common in high humidity environments. Radon gas has not appeared to be a problem with the type of subsoll conditions we have on the prairies. Ozone can be a concern in printing shops and in inadequately ventilated photo copying areas.

The feeling of stuffiness, due to lack of adequate fresh air and circulation of air, is perhaps the most common complaint encountered in a typical office. Odours may signal the presence of chemicals or other contaminants.

Alberta Public Works, Supply and Services guide, as mentioned above require a minimum set amount of fresh air. In addition, almost all government owned facilities utilize a "free-cooling" concept for ventilation. This means that for the greater part of the four seasons, buildings are cooled using outdoor air (fresh air). Therefore all or most of the air is circulated only once and then exhausted, providing an almost outdoor atmosphere within.

#### ▲ Carbon Dioxide

Carbon dioxide ( $\text{CO}_2$ ) occurs naturally at about 350 ppm (parts per million). At higher levels, it has proven to be an excellent indicator of ineffective ventilation. A reading of up to 800 ppm  $\text{CO}_2$  (adopted as the Government standard) indicates an acceptable supply of fresh air.

#### ▲ Carbon Monoxide

Carbon monoxide (CO) is a product of incomplete combustion. Generally burning tobacco (cigarette smoking) is the major source of carbon monoxide in the office. Another common source may be automobile exhaust fumes entering the building through low level air intakes or from attached car parkades that are not ventilated sufficiently. Symptoms of exposure to moderate levels of carbon monoxide include headaches and dizziness.

#### ▲ Formaldehyde

Formaldehyde is one of the many volatile organic compounds found in the office environment.

Formaldehyde is present in some new construction materials, particle board furniture, new carpet and carpet backing, some aerosol sprays and urea-formaldehyde cleaning agents. Allowing sufficient time for "curing" or "off gasing" and higher levels of ventilation after materials are installed will decrease the levels of formaldehyde vapours.

*The most common noticeable ill effects are eye, nose, and throat irritation, respiratory disorders, and allergies.*

#### **▲ Dust Particulate**

Dust particulates are particles of dust that have been generated from many sources such as paper, copy machines, household lint, dust from outdoors, carpets, clothes, etc.

Dust particulate can best be controlled with high efficiency fresh air filters and good housekeeping management.

#### **▲ Older And Leased Facilities**

Older owned or leased facilities may not be able to meet present day guides.

For example, previous ASHRAE guides for fresh air were one half (50%) of those required presently.

**For further information on thermal comfort and air quality consult with your Accommodations/Facilities Contact person or refer to Part 8 and 9 respectively of the CAN/CSA Standard for Office Ergonomics.**

## **JOB DESIGN**

Increased automation has changed many office jobs. Automation has often led to jobs that require sitting or standing in one position for long periods while doing repetitive tasks. This causes health problems including musculoskeletal strain, visual fatigue, restricted blood circulation, and stress from lack of or too much mental activity.

### **Well designed office jobs:**

- minimize energy expenditure and force requirements
- balance tasks and provide changes in body position and mental activity
- allow some decision-making so workers can vary activities according to personal needs, work habits and circumstances in the workplace
- give workers a sense of accomplishment
- provide good work/rest schedules
- provide feedback to workers about how they are doing

### **Preventing Job Design Problems**

Ensure that workers take regular rest breaks. Encourage workers to stand up, move around and change mental activity during rest breaks. Changing the activity and/or performing simple (short) exercises (muscle and visual) at the workstation eases muscle aches and eyestrain.

Vary work task. Break up computer work with non-computer tasks to ensure change in body position and mental activity.

Set a reasonable work pace. Working too quickly contributes to muscle strain. Working too slowly contributes to boredom.

## **TRAINING**

Training may be indicated by a variety of factors. Training is likely to be needed when a new employee enters the organization, or on an ongoing basis to refresh the skills of longer-term employees or if they are experiencing injuries during the operation of computer. Training will be needed when new technology is introduced. Effective training can result in improved health and safety, higher job satisfaction, better performance and enhanced employee development and growth. Depending on the nature of the training needed, different types, levels, and methods of training will be required.

**Effective training for the new office technology should:**

- ▲ provide for a clear understanding of the technical operation of the equipment
- ▲ show how the job to be accomplished relates to the organizational mission
- ▲ define the new job responsibilities
- ▲ provide knowledge on ergonomic and environmental factors and skill in the operation of the ergonomically designed equipment, furniture and workstation.

Not only do the operators of the new electronic equipment require training, but also managers and supervisors. They need to know what the new equipment is or is not capable of, as well as the human and policy issues surrounding its use.

Task related training pertaining to the operation of the equipment is available from equipment suppliers and should be arranged for at the time of purchase of the equipment. Contact your Department Occupational Health and Safety Office to get assistance in obtaining training related to the implementation of the new office technology, the application of ergonomic principles, and the proper use of ergonomic furniture.

## **GLOSSARY OF TERMS**

In this guide, the meaning of certain words are defined below

<b>ASHRAE</b>	stands for American Society of Heating, Refrigerating and Air-Conditioning Engineers.
<b>Acoustical Screens</b>	movable freestanding screens constructed of sound absorbing material, usually fabric and used to form portable walls around furniture in open office areas.
<b>Connection Lines</b>	lines drawn to show activity links and movement of a worker between equipment and furniture in a work area.
<b>Cumulative Trauma Disorder</b>	see Repetitive Strain Injury.
<b>Equipment</b>	includes electronic devices used in the office - visual display terminal, central processing unit, keyboard, plotter, printer.
<b>Ergonomics</b>	the matching of task demands to human capabilities to improve worker capacity and well being. It involves the study of the interaction between people, their task, the environmental conditions, equipment and furniture in the workplace.
<b>Furniture</b>	furnishings used to support the computer user's body, office equipment and work material and includes chair, work surface and storage shelving.
<b>Musculoskeletal</b>	refers to the bones, muscles, tendons and ligaments which provide support and strength for the body and allow movement.
<b>Repetitive Strain Injuries (R.S.I.)</b>	is a collective term for a range of conditions characterized by discomfort or persistent pain in muscles, tendons and other soft tissues of the human body. R.S.I is usually caused or aggravated by repetitive motions, sustained or constrained postures, and forceful movements. In the office environment, R.S.I. usually affects the wrist, elbow, shoulder, neck or lower back. (Also called cumulative trauma disorders (C.T.D.) or occupational overuse syndrome (O.O.S.)

## **GLOSSARY cont;**

<b>Stationery Items</b>	Items not considered as office furniture and not included in P.W.S.S. Standard Furniture Catalogue, e.g. document holder, footrest, etc.
<b>Task Lighting</b>	a light fixture which provides localized illumination upon a specific task(s).
<b>Visual Fatigue/Discomfort</b>	symptoms of discomfort or pain involving the eyes. Includes irritation, burning, pain, blurring of vision, headaches, difficulty focusing, tiredness of the eyeball.
<b>Volatile Organic Compounds</b>	substances composed of two or more elements one of which contains carbon, joined together chemically.
<b>Wire Management</b>	the responsibility of organizing the necessary wiring and cable to an electronic workstation including the distribution of the electrical systems within the workstation.
<b>Workplace</b>	the whole office area, including groups of workstations, common rooms, storage and equipment areas.
<b>Worksite</b>	a location where a worker is engaged in an occupation.
<b>Workstation</b>	the space occupied by one individual working independently or a small group of people working as a team and sharing information and support equipment on a continual basis.
<b>Worksurface</b>	the surface upon which the individual can write and support reading material and equipment.

## **LIST OF RESOURCES**

### **Literature**

- A Guideline on Office Ergonomics, A National Standard of Canada, CAN/CSA-Z412-M89
- People and Productivity. A Manager's Guide to Ergonomics in the Electronic Office,  
Marvin J. Dainoff and Marilyn Hecht Dainoff
- Government of Alberta Personnel Policies and Procedures, Directive 12-15  
Facility Environmental Concerns, and Directive 12-17 - Office Ergonomics
- Alberta Occupational Health And Safety Library

### **Technical Services**

- Department Accommodation/Facilities contact person
- Department Occupational Health and Safety Office
- Occupational Health and Safety Branch, Personnel Administration Office
- Design Standards and Furniture Branch, P.W.S.S.  
(accessed through Department Accommodation/Facilities contact person)
- Alberta Occupational Health And Safety

### **Training**

- Department Staff Development Officer
- Department Occupational Health and Safety Office
- Occupational Health And Safety Branch, Personnel Administration Office



## **APPENDIX "A"**

## **TASK DESCRIPTION FORM**

**Location:** \_\_\_\_\_

**Job:** \_\_\_\_\_

**Plan/Analysed by:** .....

**Date:** .....

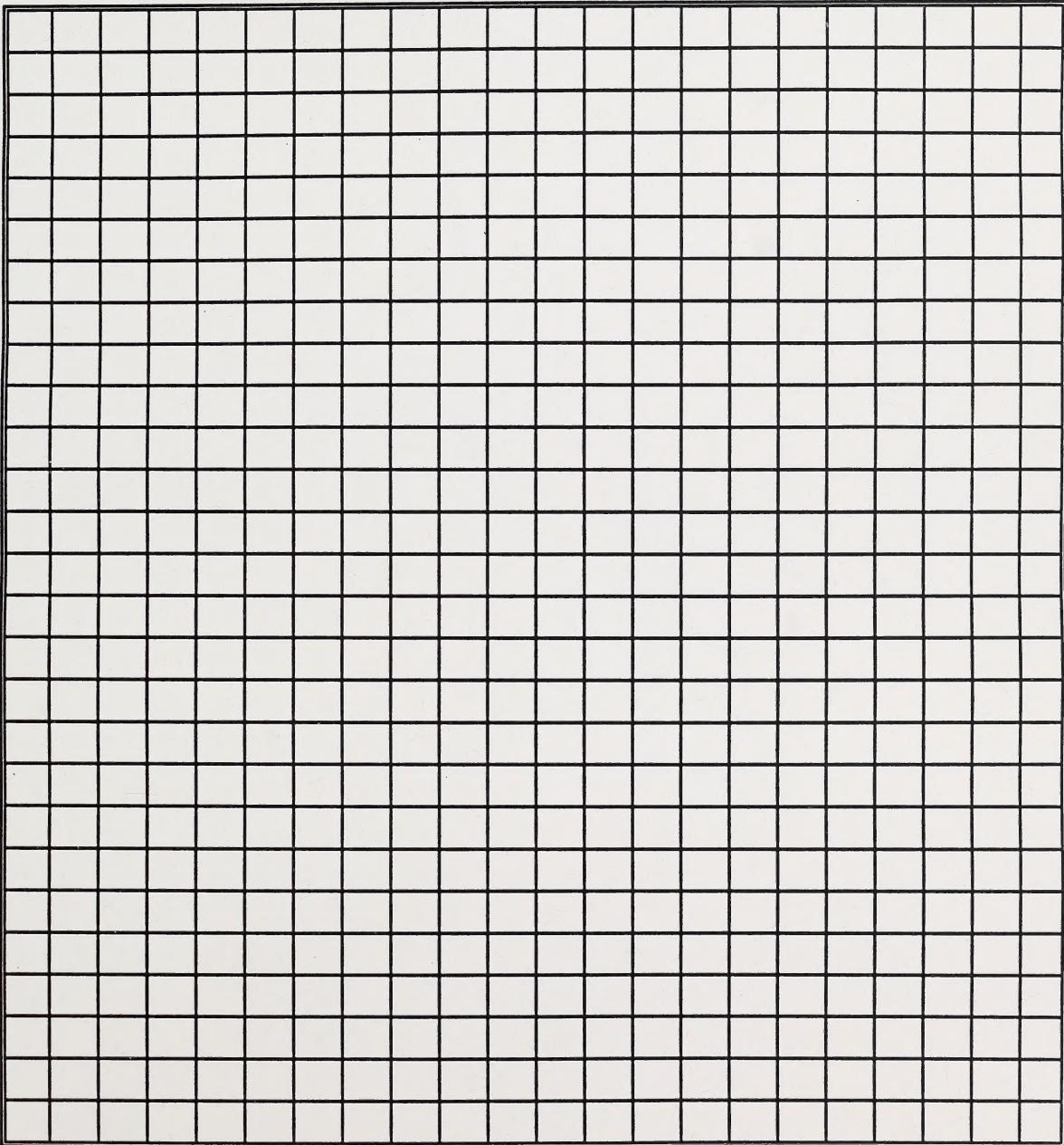
**Task Description:** . . . . .



## **APPENDIX "B"**

### **WORKSITE SKETCH**

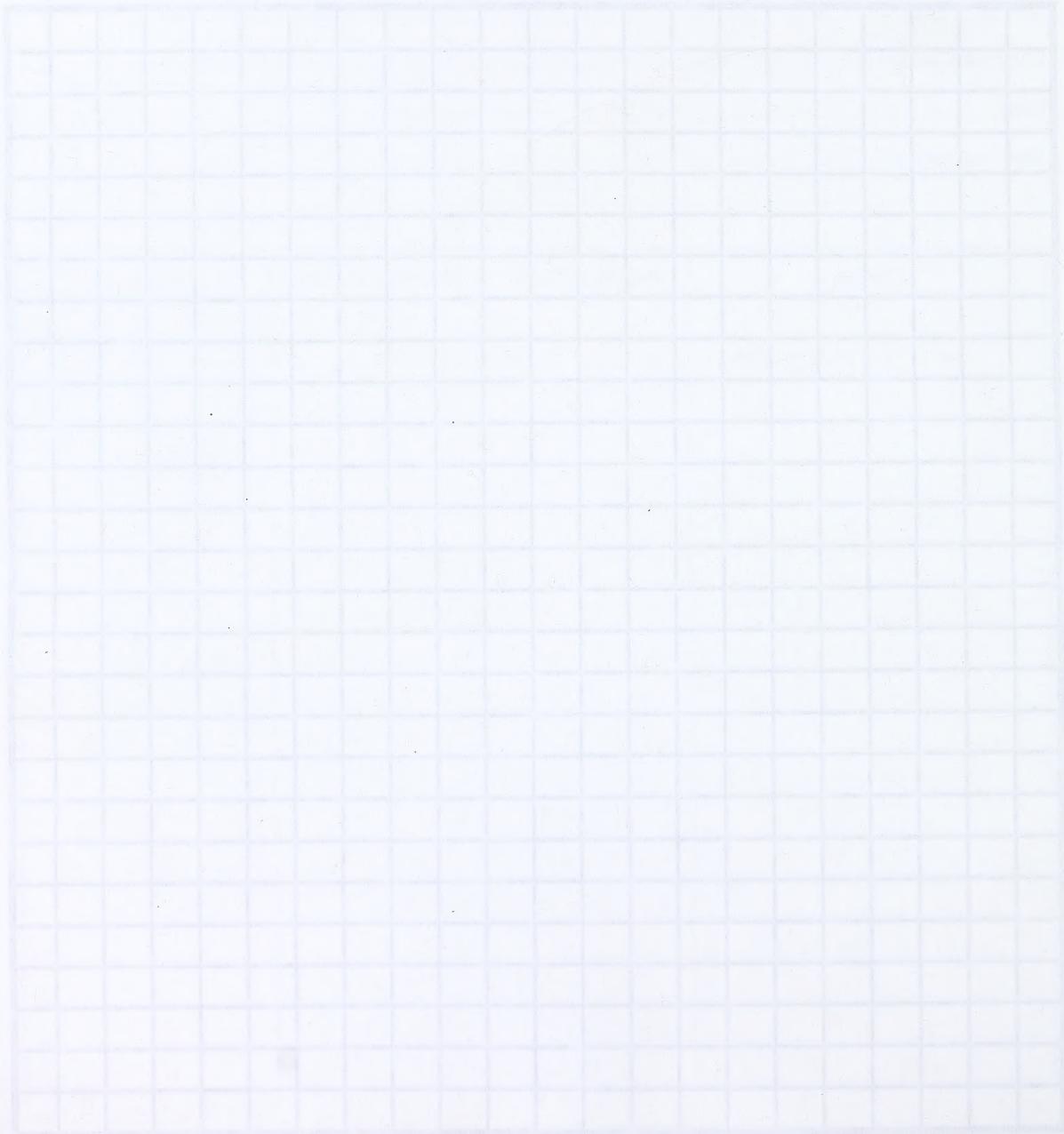
Sketch here the floor plan of the worksite. Don't worry about scale but write in all important dimensions. Note the position of doors, windows, lights, and frequently used or obstructive equipment and furniture. Computer workstations should be clearly identified.



"B" KICKERS

NOTE ATTACHED

and start advertising throughout the area and since Radio 1000000 will be relay used and most towns  
in region around the stations concerned to have permanent time signal equipment made to receive  
beamed signals so blocks elimination





na Library Canada  
Bibliothèque nationale du Canada

3 3286 51967208 9